Perennial grass biomass is related to grazing exclusion and ecological site, but not mesquite cover

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Key Findings

Perennial grass biomass was generally not influenced by mesquite cover between 0 and 43%, but biomass was reduced by grazing and varied by ecological site.

1. Introduction

Background

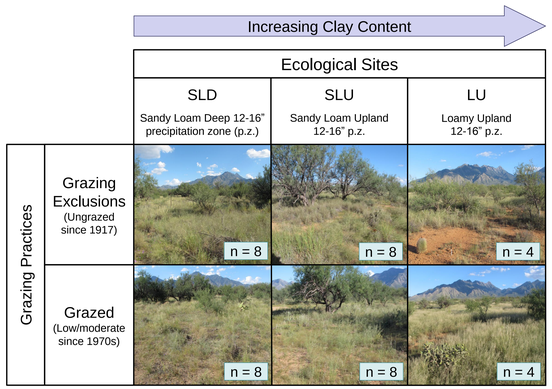
Shrub encroachment is well documented in western North America. In the southwest, mesquite (*Prosopis spp.*) has increased in abundance over the last 150 years. Mesquite is often believed to alter ecosystem structure by reducing grass abundance.

Research Questions

- Is perennial grass biomass related to mesquite cover, livestock grazing or grazing exclusion and/or ecological site?
- Does the mesquite-grass relationship vary between native and introduced grass species?

2. Methods

a. Study Site: Santa Rita Experimental Range



b. Plant Measurements

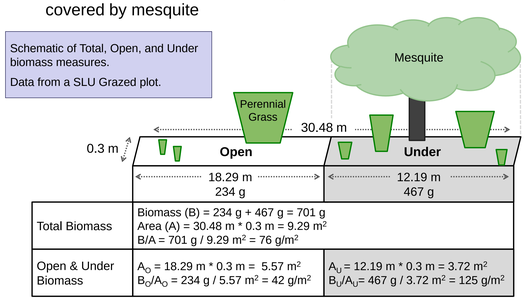
- Perennial grass: basal diameter (cm) converted to biomass (grams)
  - *Biomass* (g) = $e^{1.441}$ x *diameter* (cm)$^{1.253}$
  - Biomass represents net primary productivity, not standing biomass
- Mesquite: line intercept (% foliar cover) converted to area (m^2)

c. Three Biomass Measures (g/m^2)

1. **Total**: Total biomass / plot
2. **Open**: Total biomass not under mesquite / area of the plot not covered by mesquite
3. **Under**: Total biomass covered by mesquite / area of the plot covered by mesquite

Schematic of Total, Open, and Under biomass measures.

Data from a SLU Grazed plot.

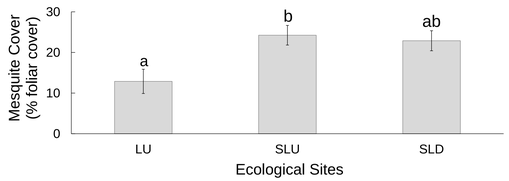


3. Results

a. Mesquite Cover

- Mesquite cover ranged from 0 to 42.6%
- Mesquite cover did not vary between ungrazed and grazed areas

LU had less mesquite cover than SLU and SLD

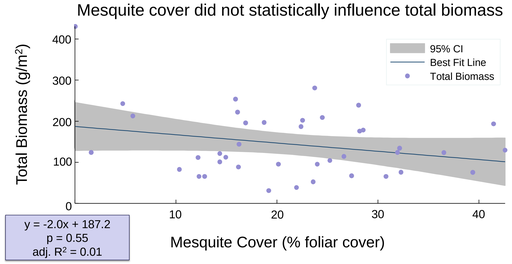


Error bars are ± standard error of the mean. Different letters indicate significant ($p \leq 0.05$) differences using a two-way ANOVA.

b. Mesquite Cover vs. Biomass

- Regressions were limited to SLU and SLD
- Native open was the only category to have a significant p-value: native biomass in the open was reduced with increasing mesquite cover (but with a low adjusted R^2, 0.16)

Mesquite cover did not statistically influence total biomass

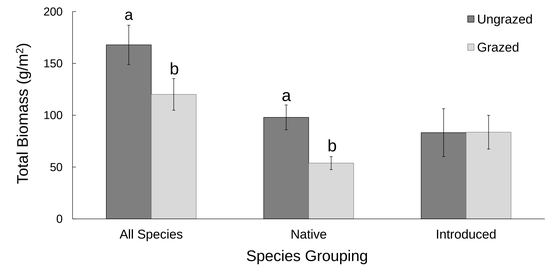


c. Grazing Practices X Ecological Sites

- Based on a two-way ANOVA, there were no interactions
- Evaluated grazing practices and ecological sites separately

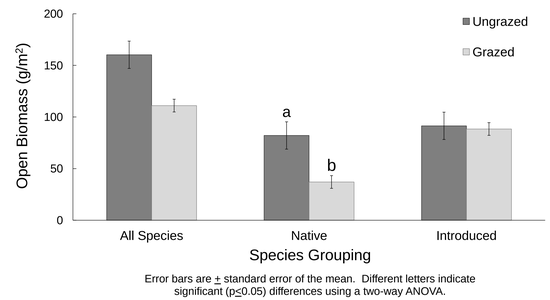
d. Grazing Practices

Total and native biomass was greater in ungrazed areas



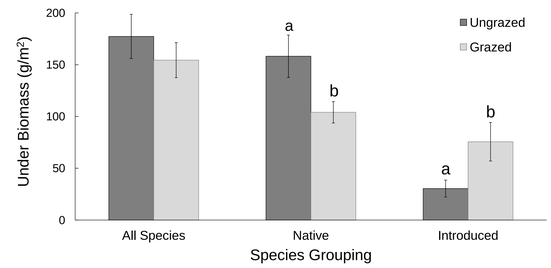
Error bars are ± standard error of the mean. Different letters indicate significant ($p \leq 0.05$) differences within groups using a two-way ANOVA.

Native biomass was greater in the open in ungrazed areas



Error bars are ± standard error of the mean. Different letters indicate significant ($p \leq 0.05$) differences using a two-way ANOVA.

Native biomass was greater under mesquite without grazing
Introduced biomass was greater under mesquite with grazing



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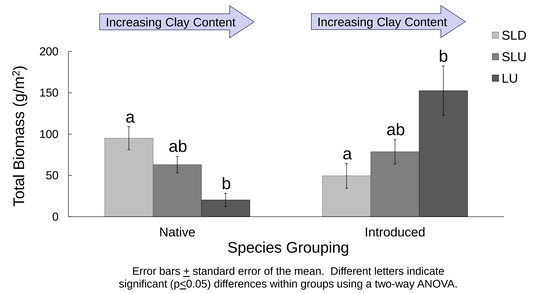
e. Ecological Sites

Total native biomass was greatest in SLD
Total introduced biomass was greatest in LU



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- Total biomass did not differ for all species (native + introduced) across ecological sites
- Open biomass followed the same pattern as total biomass
- Under biomass had no differences among ecological site

4. Discussion and Conclusions

Grass is unrelated to Mesquite at the Plot Scale

- Mesquite cover did not differ between grazing practices.
- Less mesquite in clay sites was consistent with finer soils (clays) favoring shallow rooting species over deep rooting species (mesquite).
- Unexpectedly, perennial grass biomass was generally not related to mesquite between 0 and 43% cover.

Grazing reduced Grass Biomass

- Grazing (even at low/moderate stocking rates the since 1970s) reduced biomass, primarily through a decline in natives. Natives appear less resilient to repeated defoliation, possibly due to a lack of evolutionary history of grazing.
- In the fertile islands beneath mesquite, grazing tolerance varied. Natives declined with grazing and introduced species increased with grazing.

Grass Composition varied by Ecological Site

- There was no difference in total grass biomass along a clay gradient, due to the opposite behavior of native and introduced species.
- Less native biomass with increasing clay may be related to lower native species richness.

Acknowledgements

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